SUBJECT SPECIFICATION

1. BASIC DATA

1.1. Title

DYNAMICS OF STRUCTURES

1.2. Code

BMEEOTMAS43

1.3. Type

contact lesson unit

1.4. Contact hours

- lectures: 2 lesson/week

1.5. Evaluation

semester mark

1.6. Credits

3

1.7. Coordinator

Dr. Németh Róbert, associate professor (@: nemeth.robert@epito.bme.hu)

1.8. Department

Department of Structural Mechanics (http://www.epito.bme.hu/me)

1.9. Website

http://www.epito.bme.hu/BMEEOTMAS43

1.10. Language of instruction

Hungarian and English

1.11. Curriculum requirements

- compulsory az Építőmérnöki (BSc) szak Szerkezet-építőmérnöki ágazatán

1.12. Prerequisites

- Required previous subjects
  - BMEEOTMAT43: Structural Analysis I. (midterm signature)
  - BMETE90AX07: Matematics A3 for civil engineers (midterm signature)
- Recommended subjects
  - BMEEOTMAS42: Structural Analysis II.

1.13. Effective date

from 1 September 2017.

2. OBJECTIVES AND LEARNING OUTCOMES

2.1. Objectives

The aim of the subject is to introduce the basic concepts of mechanical vibration analysis of civil engineering structures, analysis of free and excited vibrations of SDOF, MDOF, and continuum structures using manual or computer methods, especially the mechanical background of support vibration and earthquake analysis.

2.2. Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the terms used in the analysis of mechanical vibrations,
2. knows the differential equations describing the vibrations of SDOF, MDOF, and continuum systems, and the physical meaning of the quantities within,
3. knows the equations describing the free motions of systems, the concept of free vibration and the solution of the differential equation,
4. knows the equations describing the motion of systems subjected to harmonic excitation, the concept of harmonic vibration and the solution of the differential equation for systems with single or multi degrees of freedom,
5. knows the equations describing the motion of systems subjected to arbitrary excitation in time, the concept of arbitrary vibration and the solution of the differential equation for systems with single degree of freedom,
6. knows the equations describing the motion of systems subjected to variable displacement of supports in time, the concept of vibration due to support movement and the solution of the differential equation with respect to displacements and deformations for systems with single or multi degrees of freedom,
7. clearly understands the mechanical meaning of concepts related to earthquake analysis,
8. clearly understands the concept of equivalent static loads.

B. Skills

1. is able to model real systems as systems with single or multi degrees of freedom,
2. calculates the equivalent quantities (mass, stiffness) of the mechanical model in the case of small number of degrees of freedom,
3. calculates the eigenfrequencies and vibration modes of the mechanical model in the case of small number of degrees of freedom,
4. calculates the responce of the mechanical system to dynamic loads in the case of small number of degrees of freedom,
5. is able to solve complex, computationally demanding problems using his/her IT knowledge,
6. is able to express his/her thoughts in an organized way,

C. Attitudes

1. aims at learning and routinely using tools required for solving mechanical vibration problems,
2. aims at accurate and flawless problem solving,

D. Autonomy and responsibility

1. is able to individually analyse dynamics problems and tasks and to solve them using the given resources,
2. is open to valid criticism,
3. applies a systematic approach in his/her reasoning.

2.3. Methods

Lectures, solution of practice problems in individual or team work.

2.4. Course outline

week	Lecture topics
1.	Structures with single degree of freedom: modelling, free vibration
2.	Structures with single degree of freedom: harmonic excitation
3.	Structures with single degree of freedom: damped vibration
4.	Structures with single degree of freedom: support vibration
5.	Partial summary
6.	Structures with multi degree of freedom: modelling, system matrices
7.	Structures with multi degree of freedom: free vibration
8.	Structures with multi degree of freedom: excited vibrations
9.	Structures with multi degree of freedom: support vibration
10.	Partial summary
11.	Vibration of bar structures: finite element modelling
12.	Vibration of bar structures: continuum vibration
13.	Vibration of bar structures, repetition
14.	Summary

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5. Study materials

- Books: Györgyi J.: Dinamika (Műegyetemi Kiadó, 2003)
- Online materials: Németh R.: Előadásfóliák (http://www.epito.bme.hu/BMEEOTMAS43)

2.6. Other information

2.7. Consultation

The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail: nemeth.robert@epito.bme.hu.

SUBJECT REQUIREMENTS

3. ASSESSMENT AND EVALUATION OF THE LEARNING OUTCOMES

3.1. General rules

- Evaluation of learning outcomes described in Section 2.2. is based on three mid-term written checks.
- The dates of the checks can be found in the "Detailed semester schedule" on the website of the subject.

3.2. Assessment methods

Evaluation form (type)	abbrev.	assessed learning outcomes (2.2)
1st mid-term test (summarizing check)	**ZH1**	A 1-7, B 1-6, C 1-2, D 1-3
2nd mid-term test (summarizing check)	**ZH2**	A 1-8, B 1-6, C 1-2, D 1-3
3rd mid-term test (summarizing check)	**ZH3**	A 1-3, B 1-6, C 1-2, D 1-3

Dates and deadlines of evaluations can be found in the „Detailed course schedule” on the subject’s website.

3.3. Evaluation system

Evaluation	score
ZH1 (1st mid-term test)	50%
ZH2 (2nd mid-term test)	50%
ZH3 (3rd mid-term test)	50%
sum in the midterm	100%

Only the best two mid-term test results are considered (that is why the sum of the weights above is not 100%).

3.4. Requirement and validity of signature

There is no signature from the subject.

3.5. Grading system

- No requirements are made on the successfulness of the tests.
- The semester performance is determined by the results of the best two mid-term tests.
- the final result is computed by the weighted average A of the best two mid-term tests as in section 3.3.:

Average	grade
86%≤A	5 (Excellent)
74%≤A<86%	4 (Good)
62%≤A<74%	3 (Satisfactory)
50%≤A<62%	2 (Passed)
A<50%	1 (Failed)

3.6. Retake and repeat

- Mid-term test cannot be retaken in this subject.

3.7. Estimated workload

activity	hours/semester
contact lessons	**14x2=28**
preparation for lessons during the semester	**14x1=14**
preparation for the checks	**3x10=30**
study of the assigned written sources	**18**
in total	**90**

3.8. Effective date

from 1 September 2017.